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Bio-Economics of Scampi (Macrobrachium Rosenbergii) Polyculture in Selected Ponds at Namkhana Block in South 24 Parganas District of Coastal West Bengal Over the Year 2014

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Abstract: ***For the coastal region aquaculture prawn farming will remain an important part of the rural economy. The consumption pattern and its market is mainly based upon the local market within a radius of 50 kms. In South 24 Parganas, farmers turned to prawn culture when frequent disease occurrence forced them towards stopping of shrimp production due to it's high economic risk factor. Despite the risk involved, prawn farming yields higher net profits than most other occupations and farmers rarely subsidize their income with other activities. The targeted quality measures, application of proper culture techniques, export policy promotion, adequate quality control mechanism aimed to marketing strategy along with product promotion, and sustainable market price, sufficient supply of institutional credit and such other base facilities are the important factors for sustainable development and long term viability of prawn farming industry. If effective management strategies are being adopted and government intervention be in tune then certainly the employment generation will take place.***

Keywords: Coastal aquaculture, Prawn culture, Sustainable development , Management strategies, Employment generation

1. Introduction

The present world population is expected to grow from 6.1 billion people to 9 billion by 2050 (UN, 2000). The demand of aquatic products for human consumption will grow to 121.1 million metric tons by 2010 (WijkstrŐm, 2003) from its present production level of 101 million metric tons (FAO, 2004). So there is a need for rapid expansion of aquaculture for the developing countries like India. In this aspect Prawn farming with Indian Major Carps is a lucrative approach. Primitive methods of prawn culture had been practiced for centuries in some Asian countries, especially in India and Bangladesh. Ling (1969) first studied the life cycle and Hameed (2000) demonstrated mass rearing techniques of juveniles of *M. rosenbergii*.

The first juvenile prawns were produced in June, 1962 and within a period of about ten years, worldwide interest in freshwater prawn culture was generated and research and development started practically in all the Asian and far Eastern countries (Lin, 1988). Burma, Bangladesh, India, Indonesia, Kampuchea, Malaysia, Philippines, Sri Lanka, Thailand and Vietnam have their own native stock. However, Australia, England, Hawaii, Japan and Singapore obtained their initial stock from Malaysia, Israel, Taiwan, Province of China, imported stocks from Thailand (Lin, 1988). Males can grow to 320 mm and easily are recognized by their extremely long claws; females are smaller, reaching 250 mm total length (TL) (FAO, 2005–2012). Ling (1969) earlier recommended polyculture of M. rosenbergii with non-carnivorous freshwater fish such as carps and tilapia. Moreover, the polyculture of M. rosenbergii with Chinese and Indian major carps has been reported from different parts of the world in recent years (Alam et al., 2001).

2. Materials and Methods

The present study is based on traditional *Macrobrachium rosenbergii* polyculture with IMCs conducted in Namkhana blocks of South 24 pgs district, West Bengal during the months of February 2014 to July 2014. Before the commencement of fieldwork, a pilot servey was conducted during the month of January 2014. Based on that pilot servey, Namkhana Dev. blocks of South 24 pgs district is selected for final study. Purposive sampling method was used while selecting the study area. The primary and secondary data collection was conducted in Kakdwip sub-division in South 24 Parganas at Stage- 2 level of the sampling frame. These sub-divisions are exists mostly direct and indirect effects of environmental and natural parameter, which are reasons for better economic profitability for both monoculture and polyculture of *Macrobrachium rosenbergii*. Kakdwip sub-division contains four blocks, among them Namkhana block is chosen for suitable study region and better transportation from Kolkata (Namkhana railway station and Kakdwip bus stand are nearer to Namkhana block). Namkhana block is surrounded by Kakdwip, Sagar, Parthapratima blocks and Bay of Bengal.

3. Results and Discussion

Concise Analytical Discussion for Average Economics (unit 1 bigha) in connection with Capital Cost for Scampi Farming considering all the involved parameters during 2013.

The linear regression equation (Table 2) taking capital cost as dependent variable and other variables viz. lease amount, construction of pond, inlet and outlet structure, pump house cum workshop, watchman shed, pumps, electric installation, land and farm equipments, miscellaneous and capital cost as independent variables. The equation revealed as below:
Total Capital Cost (TCC) (Rs.) = -775.099 + (1.036 x Lease amount) +(.604 x Pumps) +(1.265 x Land and farm equipments) + (38.089 x Miscellaneous)

The equation clearly indicates that the most important variables (average value calculated for 1 bigha area, in all the cases) are Miscellaneous and Land and farm equipments. Both of them have positive impact upon Total Capital Cost (TCC) (Rs.). All the other independent variables have positive impact upon Total Capital Cost (TCC) (Rs.). The 95% Confidence Interval i.e. the lower and the Upper boundaries are depicted as: Lease amount (1.036, 1.036), Land and farm equipments (1.265, 1.265), Pumps (.604, .604), Miscellaneous (38.089, 38.089).

Concise Analytical Discussion for Average Economics (unit 1 bigha) in connection with Variable Cost for Scampi Farming considering all the involved parameters during 2013.

The linear regression equation (Table 3) taking Total Variable Cost (TVC) (Rs.) as dependent variable and other variables of Total Variable Cost (TVC) (Rs.), viz. cost of chemicals and manure, cost of seeds, Cost of IMC (fingerling/table size), cost of feed, fuel charges, electricity charges, labour charges, medicines, annual maintenance and repairing cost, miscellaneous expenditure as independent variables. The equation revealed as below:

Total Variable Cost (TVC) (Rs.) = 19344.058 + (0.962x Cost of IMC (fingerling/table size)) + (0.826 x Labour charges) + (5.835 x Annual maintenance and repairing cos) + (21.317 x Miscellaneous)

The equation clearly indicates the most important variables (average value calculated for 1 bigha area, in all the cases) are Miscellaneous and Annual maintenance and repairing cost. Both of them have positive impact upon Total Variable Cost (TVC) (Rs.) All the other independent variables viz. labour charge and Cost of IMC (fingerling/table size) have positive impact Total Variable Cost (TVC) (Rs.). The 95% Confidence Interval i.e. the lower and the Upper boundaries are depicted as: Cost of IMC (fingerling/table size)(.962, .962), Labour charges (.826, .826), Annual maintenance and repairing cost (5.835, 5.835), Miscellaneous (21.317, 21.317).

Concise Analytical Discussion for Average Economics (unit 1 bigha) in connection with Fixed Cost for Scampi Farming considering all the involved parameters during 2014, over Stations 3.

The linear regression equation (Table 4) taking Total Fixed Cost (TFC) (Rs.) as dependent variable and other variables of Total Fixed Cost (TFC) (Rs.), viz. Depreciation on capital cost @ 7%, Interest on capital cost @ 13.2%, Interest on variable cost @ 13.2%, as independent variables. The equation revealed as below:

Total Fixed Cost (TFC) (Rs.) = 0 .057 + (1.530 x Interest on capital cost @ 13.2%) + (1.000 x Interest on variable cost @ 13.2%)

The equation clearly indicates the most important variables (average value calculated for 1 bigha area, in all the cases) are Interest on capital cost @ 13.2% and Interest on variable cost @ 13.2%. Both of them have positive impact upon Total Fixed Cost (TFC) (Rs.). The 95% Confidence Interval i.e. the lower and the Upper boundaries are depicted as: Interest on capital cost @ 13.2% (2.886, 2.886) Interest on variable cost @ 13.2% (1.000, 1.000).

Concise Analytical Discussion for Average Economics (unit 1 bigha) in connection Profit of Scampi Farming considering all the involved parameters during 2014.

The linear regression equation (Table 5) taking Profit (Total Income - Total Expenditure) as dependent variable and other variables of viz. lease amount, construction of pond, inlet and outlet structure, pump house cum workshop, watchman shed, pumps, electric installation, land and farm equipments, miscellaneous, capital cost, cost of chemicals and manure, cost of seeds, Cost of IMC (fingerling/table size), cost of feed, fuel charges, electricity charges, labour charges, medicines, annual maintenance and repairing cost, miscellaneous, Depreciation on capital cost @ 7%, Interest on capital cost @ 13.2%, Interest on variable cost @ 13.2%, Total Expenditure, Contribution of Prawn in Profit, Contribution of IMC in Profit as independent variables. The equation revealed as below:

Profit (Total Income - Total Expenditure) = 64097.889 + (37.108x Pumps) + (-31.965x Land and farm equipments) + (-606.245 x Miscellaneous) + (3.953x Contribution of IMC in Profit)

The equation clearly indicates the most important variables (average value calculated for 1 bigha area, in all the cases) are Miscellaneous and Pumps. Former has negative impact but has positive impact upon Profit (Total Income - Total Expenditure). All the other independent variables viz. Land and farm equipments and Contribution of IMC in Profit, the former have negative impact Profit (Total Income - Total Expenditure). The 95% Confidence Interval i.e. the lower and the Upper boundaries are depicted as: Pumps (37.108, 37.108), Land and farm equipments (-31.965, -31.965), Miscellaneous (-606.245, -606.245), Contribution of IMC in Profit (3.953, 3.953).

4. Conclusion

For more sustainable culture practices to the aquaculture community in West Bengal, it includes augmenting existing certification programs and community level planning and training. Also the existing system is lacking to monitor water

qualities which have significant impacts, but few respondents measured water quality due to lack of equipment. Government funding to provide equipment or regular testing by district fisheries department is needed. In spite of all the major constraints, still prawn culture can give exciting rewards towards socio- economic development for a large number of rural people. But the only factor that is pulling them back is low growth rate and mortality. The distinct quality measures, application of scientific method, export policy promotion, proper quality control mechanism targeted to marketing strategy and product promotion, and presence of recent day technology, sustainable market price, insufficient supply of institutional credit and such other ancillary facilities are the crucial factors, for sustainability and long term viability of prawn farming industry. Crop insurance facilities should be introduced so that the farmers would not bury them under debt burden of lease or bank loan if there is a loss. The motto should be to practice an economically and ecologically viable scampi culture. Besides all these, Government's efforts in implementing a proper planning and management oriented marketing strategies are required for the sustainability of the industry. The adoption of such measures can revive the scampi industry and make it a major contributor in earning foreign exchange for our country and at the same time play a crucial role to the employment generation and socio-economic upliftment of a major portion of coastal rural fisher folk.

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Appendix

Table 1: Average Economics of Scampi polyculture at Namkhana Block South 24 Parganas during 2013: Schedule Depicted on Pond Size of 1333.33 m^2 (1 Bigha)

A	Capital Cost (C.C.)	
	Lease amount	9000
	Construction of ponds	5487.5
	Inlet and outlet structure of pond	245
	Pump house cum workshop	308.33
	Watchman shed	385.83
	Pumps	3269.17
	Electric installation with electrification	188.33
	Land and farm equipments (including maintenance charge for all machineries)	2148.33
	Miscellaneous	210
	Total Capital Cost (TCC) (Rs.)	21242.5
B	Variable Cost (V.C.)	
	Chemicals and manure	915
	Cost of prawn seeds	13768.33
	Cost of IMC (fingerling/table size)	5403.33
	Cost of feed	21108.33
	Fuel charges	628.33
	Electricity charge	798.33
	Labour charges	1464.17
	Medicines	404.17
	Annual maintenance and repairing cost	1389.17
	Miscellaneous	591.67
	Total Variable Cost (TVC) (Rs.)	46470.83

C	Fixed Cost (F.C.)	
	Depreciation on capital cost @ 7%	1486.98
	Interest on capital cost @ 13.2%	2804.01
	Interest on variable cost @ 13.2%	6134.15
	Total Fixed Cost (TFC) (Rs.)	10425.14
D	Income	
	A. Prawn	
	Average stocking density (no/m2)	1.87
	Average survibility @	0.80
	Total number of species survive	2001.37
	Average body weight (gm)	80
	Total biomass (Kg)	159.54
	Average selling price (Rs.)	552
	Income (Rs.)	88619.21
	B. IMC and Exotic carps	
	Average stocking density (no/m2)	1.14
	Average survibility @	0.72
	Total number of species survive	1032.2
	Average body weight (gm)	313
	Total biomass (Kg)	323.02
	Average selling price (Rs.)	117
	Income (Rs.)	37721.1
E	Total Income (A+B)	126340.3
F	Total Expenditure (TVC+TFC) (Rs.)	56895.97
G	Profit (Total Income - Total Expenditure)	69444.34
	Ratio of Income (Prawn : IMC)	2.36
	Contribution of Prawn in Profit	49203.89
	Contribution of IMC in Profit	20240.45

Table 2 : Correlations Matrix of Scampi polyculture South 24 Parganas during 2013: Schedule Depicted on Pond Size of 1333.33 m^2 (1 Bigha)

	Lease amount	Construction of ponds	Inlet and outlet structure of pond	Pump house cum workshop	Watch-man shed	Pumps	Electric installation with electrification	Land and farm equipments	Miscellaneous	Total Capital Cost (TCC) (Rs.)
Lease amount	1									
Construction of ponds	.092	1								
Inlet and outlet structure of pond	-.645	.547	1							
Pump house cum workshop	.184	.950(*)	.428	1						
Watchman shed	.673	-.208	-.842	.027	1					
Pumps	-.331	-.506	-.062	-.272	.252	1				
Electric installation with electrification	.152	-.246	-.569	.014	.827	.599	1			
Land and farm equipments	-.136	.419	.725	.232	-.800	-.440	-.932(*)	1		
Miscellaneous	-.211	.819	.491	.872	-.031	-.051	.221	-.016	1	
Total Capital Cost (TCC) (Rs.)	.992(**)	.207	-.547	.291	.613	-.377	.091	-.048	-.126	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 3 : Correlations Matrix of Scampi polyculture South 24 Parganas during 2013: Schedule Depicted on Pond Size of 1333.33 m^2 (1 Bigha)

	Chemicals and manure	Cost of prawn seeds	Cost of IMC (fingerling/ table size)	Cost of feed	Fuel charges	Electricity charges	Labour charges	Medicines	Annual maintenance and repairing cost	Miscellaneous	Total Variable Cost (TVC) (Rs.)
Chemicals and manure	1										
Cost of prawn seeds	-.954(*)	1									
Cost of IMC (fingerling/table)	-.441	.610	1								
Cost of feed	.508	-.709	-.784	1							
Fuel charges	-.606	.734	.767	-.950(*)	1						
Electricity	.889(*)	-.929(*)	-.626	.812	-.898(*)	1					
Labour charges	-.569	.536	-.271	-.073	-.001	-.343	1				
Medicines	-.093	.319	.838	-.852	.804	-.483	-.444	1			
Annual maintenance and repairing cost	.630	-.516	-.476	.363	-.627	.694	.191	-.305	1		
Miscellaneous	-.663	.435	-.127	.302	-.135	-.281	.483	-.592	-.439	1	
Total Variable Cost (TVC) (Rs.)	-.747	.630	-.003	.082	-.054	-.368	.753	-.486	-.163	.876	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 4: Correlations Matrix of Scampi polyculture South 24 Parganas during 2013: Schedule Depicted on Pond Size of 1333.33 m^2 (1 Bigha)

	Depreciation on capital cost @ 7%	Interest on capital cost @ 13.2%	Interest on variable cost @ 13.2%	Total Fixed Cost (TFC) (Rs.)	Total Expenditure (TVC+TFC) (Rs.)	Profit (Total Income - Total Expenditure)	Contribution of Prawn in Profit	Contribution of IMC in Profit
Depreciation on capital cost @ 7%	1							
Interest on capital cost @ 13.2%3	1.000(**)	1						
Interest on variable cost @ 13.2%	-.624	-.624	1					
Total Fixed Cost (TFC) (Rs.)	.983(**)	.983(**)	-.468	1				
Total Expenditure (TVC+TFC) (Rs.)	-.084	-.084	.832	.101	1			
Profit (Total Income - Total Expenditure)	.561	.561	-.879(*)	.426	-.721	1		
Contribution of Prawn in Profit	.505	.505	-.850	.369	-.725	.991(**)	1	
Contribution of IMC in Profit	.677	.677	-.822	.571	-.567	.842	.762	1

Author Profile

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